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FURTHER NOTES ON EPHEMEROPTERA FROM INDIA AND SOUTH EAST ASIA.

By M. T. Gillies, M.B., F.R.E.S.

The types of the new species described in this paper have been presented to the British Museum (Natural History) and descriptions all apply to specimens in 2 per cent. formaldehyde unless otherwise stated. Mr. D. E. Kimmins of the British Museum very kindly made available to me his lists of the world fauna.

POLYMITARCIDAE.

Povilla cambodjensis Ulmer.

This species was described by Ulmer in 1919 from material from Indo-China, in the vicinity of the river Mekong, and from a single specimen from Bangkok. Vejabhongse in 1937 described the habits of a "black-winged insect" in Bangkok that "bore a great resemblance to *Povilla corporaali*." He gave an account of the damage done to underwater structures through the wood-boring activities of the nymphs, together with a drawing of one that agrees well with Ulmer's more detailed figures published two years later. The adults emerged at night and behaved much as described below. The wings of *P. cambodjensis*, however, are white with mauve neuration, and it could under no circumstances be described as black-winged. The description could, on the other hand, reasonably enough be applied to the dark basal half of the wing of *P. corporaali*, as figured by Chopra (1927), and it seems likely that it was indeed this species that Vejabhongse observed.

During my short stay in Bangkok in the winter of 1945–6 adults of *P. cambodjensis* presented a striking instance of the ephemeral existence and abundance for which mayflies are renowned. Every night from 26th December till 9th January the house was suddenly filled with fluttering swarms of these insects. They entered from half to three-quarters of an hour after nightfall and stayed as long as an hour, if they did not die sooner. During this time they would congregate round the lamps, fall onto the supper table, settle on clothing or the floor and there awkwardly divest themselves of their subimaginal skins. In their struggles to become airborne, and when they could presumably contain themselves no longer, the females would extrude a particularly glutinous mass of eggs onto whatever surface they might be lying on. Males were only on seldom seen, and outside the house no specimens of either sex were ever found alive, nor was their point of emergence from the innumerable waterways of the city located.

The nymph of *P. cambodjensis* remains unknown, and it is yet to be seen whether, as Kimmins (1948) has shown for the other two members of the genus, it too has the inconvenient habit of burrowing in wood.

Polymitarcys indicus Pictet.

The status and distribution of this species was discussed in detail by Chopra. It had been found up to that time in Bihar, Assam, Burma, Ceylon and in parts

of the East Indies. Dried specimens of this insect, which agree well with Chopra's description and figures, were found in profusion in cobwebs along the banks of the river Narbada some miles above Hoshangabad in the Central Provinces of India. Conditions at that time of year, April, 1945, were hot and extraordinarily dry, and it was impossible to judge how long previously the flies had emerged.

Leptophlebiidae.

Ulmer (1939) discussed the status of the known Oriental species of Leptophlebiidae in relation to the genera described from other parts of the world. He found that the species of the *Thraulus* group could not be placed satisfactorily in this genus and erected two new genera, *Thraululus* and *Choroterpides*, for them. Hagen's species *Cloë signata*, placed in *Thraulus* by Eaton, remains the sole Oriental representative of the genus. Eaton's description does not readily permit comparison.

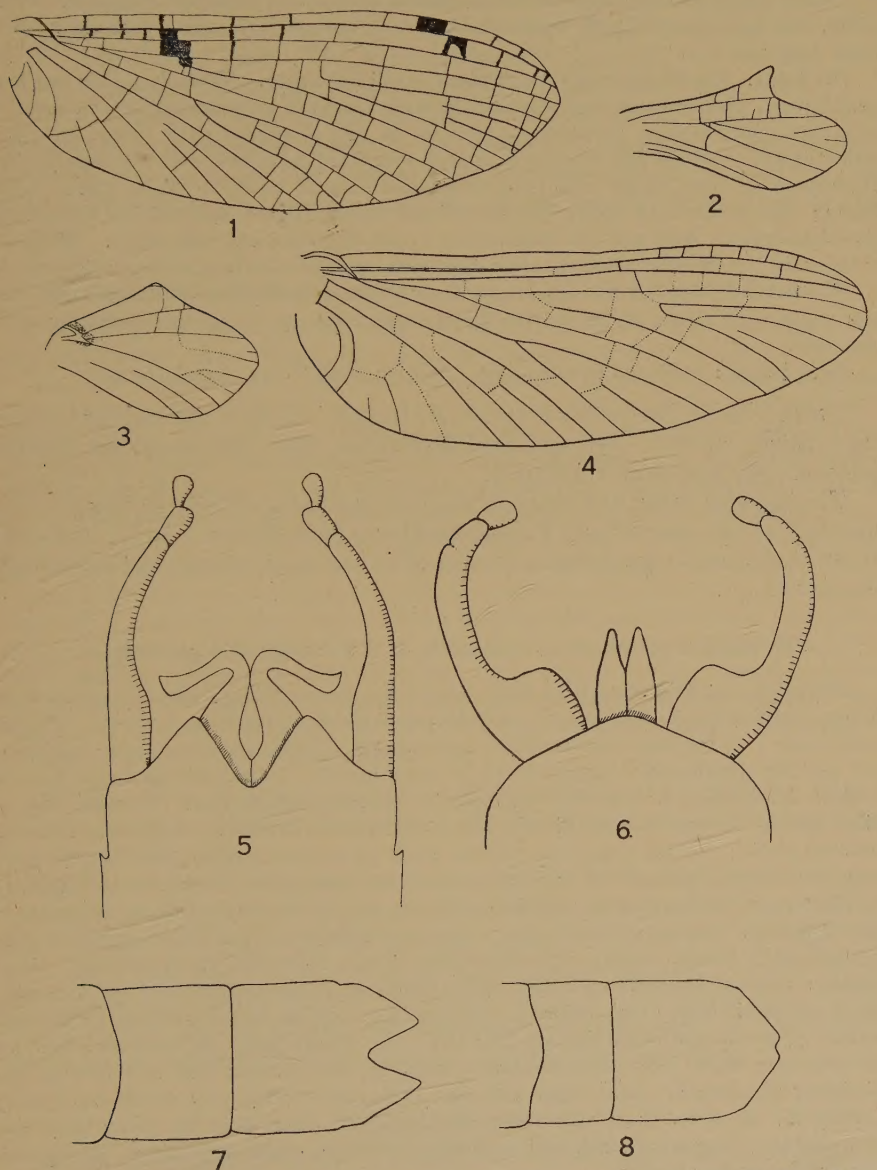
Of the two new Indian species that follow, the first, *hindustanicus*, seems nearer the American species of *Thraulus* than any of the Oriental types discussed by Ulmer. It lacks the additional pair of appendages in the male figured by Traver (1935) for the North American species, and it is not dissimilar to the Neotropical *T. bradleyi* and *T. maculatus* depicted by Needham and Murphy (1924). Despite the deviation of all these forms in certain respects from the type *T. bellus* of Europe it seems best to place this new Indian species in the old genus *Thraulus*. The second species, *parvulus*, is intermediate in genitalia and form of hind wing between the New World *Thraulus* and *Choroterpes*. It is in fact very close to Ulmer's *Thraululus*, particularly in the reduced venation of the wings and in the shape of the female subanal plate, and is accordingly placed here in that genus. But the position of both these species, as of *Habrophlebiodes semicastanea* sp. n., must be considered provisional in the absence of nymphal material. So little is known of the Oriental fauna in any case that the limits and status of any particular genus can only be guessed at.

Thraulus hindustanicus sp. n. (figs, 1, 2, 5, 7, wings and genitalia).

Male imago (in life): A delicate white and brown insect; eyes duck-egg green, thorax buff with darker markings, abdomen white; posterior margins of tergites 1–7 dark brown, most of tergites 8–9 chocolate brown. Tails white. Legs white; fore femur banded chocolate and white, other femora with a ginger spot at the apex; fore tibia with a dark spot at the distal end; wings translucent, spotted with areas of burnt umber in the anterior portion.

(In fluid): Head: oculi contiguous, blackish grey, lower portion darker, ocelli white; antennae white. Thorax cream with chocolate markings; pronotum unmarked, mesonotum with strongly marked sutures, especially at the wing root, and with two dark wedge-shaped areas posteriorly; metanotum brown in the posterior portion; mesosternum tinged with yellow antero-laterally. Abdomen: tergites 2–6 translucent white, 7–10 opaque cream; posterior margins of tergites 1–7 ringed with black; 8th tergite with a rather broader greyish band extending on to tergite 9; sternites white. Genitalia white (fig. 5). Forceps base prolonged into a deeply cleft bi-lobed plate; forceps three-jointed; basal joint three times as long as two other joints together, slightly broadened proximally, middle joint ovoid, distal joint small and bulbous; penes separate, broad at the base and tapering strongly, sinuous in form and recurved at the apex to form an acute lateral angle; in the lateral view a marked ventral angulation of the terminal portion is also apparent;

no auxiliary processes present. Tails white. Legs white ; fore femur with a brown spot at the apex, another just proximal to this and with a less definite brown band in the middle third ; tibio-tarsal joint pitch brown ; mid and hind femora with an apical brown spot ; fore tibia equal to tarsus, which is twice as long as femur ; proportions of fore tarsal joints 1 : 10 : 8 : 6 : 2. Wings (figs. 1, 2) generally colourless ; veins amber ; in the fore wing outer fifth of costal and subcostal area faintly milky ; the subcostal portion of the costal



FIGS. 1–8.—(1) *Thraulus hindustanicus*, fore wing ; (2) *ditto*, hing wing ; (3) *Thraululus. parvulus*, hind wing ; (4) *ditto*, fore wing ; (5) *T. hindustanicus*, ♂ genitalia ; (6) *T. parvulus*, ♂ genitalia (from mounted specimen) ; (7) *T. hindustanicus*, ♀ genitalia ; (8) *T. parvulus*, ♀ genitalia.

brace, all costal, most subcostal and some of the first radial cross-veins together with the immediately adjacent areas of wing chocolate brown ; in some specimens the pigment is concentrated round the bulla and at the wing tip ; venation typical of the family, cross-veins numerous, three costal cross-veins before the bulla. Hind wing small and ovoid, unpigmented, and with well formed costal spur, radial branches well developed, outer fork absent, cross-veins scanty.

Female imago (in life) : Eyes yellowish brown, thorax and abdomen chocolate, Tails white, with basal joints faintly brownish, femora striped with chocolate, fore tarsus with basal dark spot.

(In fluid) : Head dark brown, oculi black, ocelli light grey. Thoracic notum uniform dark brown ; pleurites and sternites cream, anterior border of mesosternum brown. Abdomen dark orange brown, posterior margins of the first 8 tergites pitch brown, sternites rather lighter ; 7th sternite scarcely elongated over openings of oviducts, 9th sternite (fig. 7) produced to form deeply cleft bi-lobed subanal plate as in male. Tails white. Legs cream ; fore femur with brown central and sub-apical bands ; apex of fore tibia deep chocolate brown ; hind and mid femora brown apically, tibiae and tarsi white. Wings as in the male, but the long veins are rather darker and most cross-veins are deeply pigmented.

The *male subimago* has duck-green eyes, body cream with chocolate markings ; tails and legs white with ginger stripes on the femora and wings cream spotted distinctly with chocolate.

Body length : male and female 6 mm. Wings : male 7 mm., female 7½ mm.

India : Mirik, Darjeeling District, N. Bengal. Four males and six females were caught between 18th and 23rd September, 1946, over mountain streams between 3500 and 5000 ft. altitude.

The speckled wings and shape of the male genitalia serve to distinguish this species from the clear-winged *T. signatus* Hagen from Ceylon. In the abdomen of two of the female specimens a number of nematode worms are visible through the chitin.

Thraululus parvulus sp. n. (figs. 3, 4, 6, 8, wings and genitalia).

Male imago (in fluid, specimen a little dried before preservation) : Head generally pitch brown ; oculi not quite contiguous ; ocelli brownish black, antennae dark brown. Thorax pitch brown ; metanotum with a median lighter patch. Abdomen dark brown ; segments 2–7 scarcely translucent ; tergites 9 and 10 pitch brown ; a small lateral darker line on tergites 2–7 running inwards and backwards ; sternites rather paler. Genitalia (fig. 6) pitch brown ; forceps base not divided, but is extended to cover base of penes in a gently rounded curve ; forceps stout, four-jointed, basal joint broad and rounded, second joint long and curved, arising from the outer half of the basal joint, third joint incompletely divided from preceding, fourth joint thick and elongate ; penes simple, without appendages, skittle-shaped, contiguous at the base, separated apically. Tails (basal segments only present) dark brown. Legs : fore femur dark brown, tibia and tarsus yellowish, claws darker ; mid and hind femora brown with a dark spot in the middle third and the apex, tibiae and tarsi amber ; fore femur four-fifths as long as tibia, which is slightly longer than tarsus ; proportions of tarsal joints 4 : 20 : 11 : 7 : 6. Wings (figs. 3, 4) colourless except for extreme base of fore wing and costal brace, which are dark brown ; base of hind wing also distinctly pigmented ; main veins well formed but cross-veins very scarce and poorly developed ; no costal cross-veins before the bulla and about 6 in the outer third and pterostigma ; hind wing small and somewhat spherical, costal spur obtuse and poorly developed, venation scanty.

Female imago (in fluid) : Head and antennae dark brown ; eyes black. Thorax chestnut brown. Abdomen uniform dark sherry brown ; sternites buff, 8th sternite dark brown ; no prolongation of 7th sternite over openings of oviducts ; subanal plate well

developed and with a very slight apical notch. Tails white, basal segments with brown rings at the joints. Legs : femora light brown with dark spots in the middle third and at the apex ; tibiae and tarsi cream. Wings as in male.

Body length : male 4 mm., female 4½ mm. Wings : male 4½ mm., female 5 mm.

India : Branch of the river Sonar at the 12th milestone on the Saugor–Damo road, Central Provinces. River Narbada at Hoshangabad, Bhopal State. The type-specimens, one male and three females, were caught emerging as duns at dusk, 11th March, 1945. The Narbada specimen, a male, was one of a small swarm of spinners dancing by the river, also at dusk, 14th April, 1945.

This species should be readily distinguished from the only other member of this genus, *T. marginatus* Ulmer, by the absence of pigment in the costal and subcostal regions of the fore wing and by its presence at the base of the hind wing. The costal spur of the hind wing is also less developed than in that species.

Habrophlebiodes semicastanea sp. n. (figs. 9, 10, 13, wings and genitalia).

Male imago (in life) : A rather uniformly dark chestnut-brown fly with femora and proximal portion of tibiae ginger but rest of legs white ; tails white with dark red joints.

(In fluid) : Head brown ; compound eyes broad and rather flattened, contiguous above, buff ; lower portion small and much reduced, black ; basal antennal segments brown, filament white. Thoracic notum dark chestnut brown, pleurites paler. Abdomen pale chestnut with diffuse dark shading on the tergites, especially along the lateral border. Genitalia (fig. 13) brown ; forceps base entire, not projecting beyond exsertion of forceps limbs ; these stout, three-jointed, basal joints bearing fine hairs along inner margin ; terminal joints small and globular ; penes simple, narrow and divided but closely appressed ; tips slightly thickened and bearing a minute terminal ventral hook. Tails white. Legs : femora yellowish brown, proximal one-third to a half of fore and mid tibiae and rather more than half of hind tibiae deep chestnut brown, distal portion and tarsi white. Proportions of fore leg, femur : tibia : tarsus 20 : 38 : 28 ; tarsal joints 1 : 12 : 8 : 5 : 2. Wings (figs. 9, 10) translucent colourless ; main veins of fore wing amber, cross-veins fine and numerous ; two cubital intercalaries only ; stigma containing 9–11 simple, sinuous veinlets. Hind wing short, somewhat triangular, with tall costal spur and sharply upturned subcosta.

Body length 5–6 mm. Wings 5½ mm.

India : River Mutha, near Poona. Five males caught as spinners alive in cobwebs and resting on the underside of the fronds of date palm bushes, 10th–13th September, 1945.

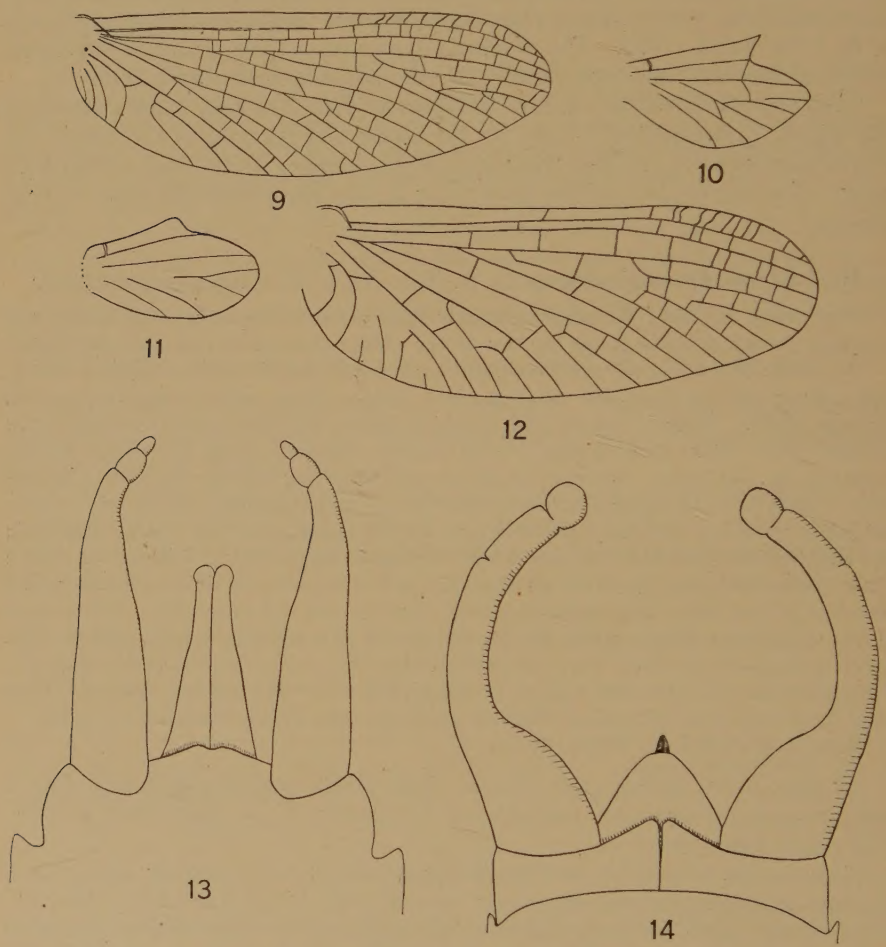
This species should be readily distinguishable by the striking colouring of the legs and unpigmented wings. It resembles *H. prominens* Ulmer, the only other species described from the Oriental region, in the form of the hind wing with tall costal spur, in the venation of the fore wing with but two cubital intercalaries, and in the forceps. It differs from this species and from the New World species by the simple, unextended forceps base and by the divided simple penes, resembling in this respect *Hagenulus karnyi* Ulmer.

Cryptopenella gen. n.

Medium-sized flies characterized by marked development of the facial region and, in the male, by prolongation of the forceps base into a penis-cover almost completely occluding the penis.

Head : nasal carina well formed and ridge-like ; lower margin of face everted and projecting directly forwards to form an irregular transverse shelf ; basal antennal joint

small, arising from the centre of a little depression and overlapped by this shelf; second joint elongate and slightly tapered, filament fine. Compound eyes flattened and contiguous. Thorax: pronotum saddle-shaped, its lateral lobes slightly overlapping the mesopleura; prosternum forming a small intercoxal hump. Abdomen: forceps of male stout, three-jointed and strongly curved; basal joint three times as long as middle joint, which is



FIGS. 9–14.—(9) *Habrophlebiodes semicastanea*, fore wing; (10) *ditto*, hind wing; (11) *Cryptopenella facialis*, hind wing; (12) *ditto*, fore wing; (13) *H. semicastanea*, ♂ genitalia; (14) *C. facialis*, ♂ genitalia.

twice the length of the globular terminal joint; middle joint incompletely divided from basal joint; forceps base projecting backwards and upwards below and behind penes to form entire penis-cover, concealing all except the tips, which are closely applied to its dorsal aspect. No elongation of 7th sternite of female; subanal plate entire and cone-shaped, extending beyond tip of abdomen. Male fore tibia $1\frac{1}{3}$ times femur and subequal to tarsus; claws unlike. Wings: main veins of fore wing well developed, cubital area containing five intercalaries; cross-veins fine but numerous, absent from marginal areas; a single

cross-vein before bulla, which contains 10–12 simple sinuous veinlets; hind wing ovoid with prominent right-angled spur, radius 1 reaching to just beyond spur.

Nymph unknown.

Genotype: *C. facialis* sp. n.

Cryptopenella facialis sp. n. (figs. 11, 12, 14, wings and genitalia).

Male imago (in life): Eyes cherry red, thorax and abdomen brownish green with paired darker stripes down the midline of the abdomen; tails white with dark brown basal annulations. Fore femora chocolate, tibia brownish, tarsi grey; hind and mid femora grey with a dark spot on the trochanter, apex of the femur and two-thirds of the way down the shaft.

(In fluid): Head chestnut brown, tips of antennae white; eyes reddish brown, cream round the sides, lower portion black; lateral ocelli white, median ocellus grey. Thorax: mesonotum chestnut brown; lighter mottled areas along the flank; sternite yellowish brown, 9th sternite darker; posterior corner of each tergite distinctly notched. Genitalia (fig. 14): forceps base and penis cover dark brown; forceps pale grey at base, becoming lighter distally; tips of penes yellow, simple and closely appressed. Tails white, basal joints ringed dark brown. Legs: fore femur chestnut brown with darker apical and subapical bands, tibia yellow, tarsus and claws white; mid and hind femora buff, similarly banded; tibiae and tarsi white; proportions of fore femur: tibia: tarsus 48 : 64 : 70; tarsal joints 2 : 30 : 22 : 12 : 4. Wings (figs. 11, 12) generally hyaline, slightly milky in costal and subcostal areas; a reddish-brown area behind costal brace.

Female imago: Markings and coloration almost exactly as in male.

Subimago (in life): Body greyish green, tails light grey, legs speckled, wings ash grey.

Body length: 5 mm. Wings: $5\frac{1}{2}$ mm.

Hong Kong: River Shing Man, near Kowloon. Eight males and 3 females were caught as duns and spinners along the banks of this rocky river, 22nd March, 1947, day temperatures 57–63° F. The river was fast, but there was an abundance of water weeds and only few Ecdyonurid nymphs were seen. This species appeared to be the dominant type at that time of year.

This genus would seem to be fairly clearly defined by the unusual and distinctive development of the penis-cover and forwards extension of the facial region. Wing venation is typical of the family. Nymphal material was unfortunately lost, but a note made at the time records that the first gill has a single filament and remaining gills several.

Isca gen. n.[1]

Small, elongate flies characterized by absent hind wing and persisting cilia in the imaginal fore wing.

Head shallow in dorsi-ventral aspect. Male eyes (figs. 16, 17) compound, adjacent but not quite contiguous, the two portions of each quite distinct; width of upper portion greater than the height; facets square, unusually large and approximately 100–120 in number. Lateral ocelli pedunculate, median ocellus rather smaller. Eyes of female (fig. 18) small, ovoid and widely separated; lateral ocelli arising opposite base of antennae. Basal antennal joint narrow and ring-like, second joint cylindrical, filament fine. Pronotum simple, posterior margin deeply excavated; prosternum a little broader than long but fore coxae not widely separated. Abdomen narrow, tergites extending round on to ventral

[1] From Isca Dumnororum, the Roman fort of Exeter, now headquarters of the Devonshire Regiment, whose indulgence towards their medical officer made these far from military studies possible.

aspect to a considerable degree, this being most marked on segment 7 but scarcely at all on segments 1 and 2 ; sternites correspondingly reduced in width (fig. 22). Ninth and 10th tergites produced backwards to form short, lateral spines ; 10th segment much reduced in size. Ninth sternite in male only very slightly produced to form entire forceps base ; forceps stout, three-jointed ; pênes simple, contiguous but not fused. Female abdomen lacking any posterior extension of 7th sternite ; subanal plate well formed and bi-lobed. Tails 3. Fore leg of male very fine, $1\frac{1}{5}$ to $1\frac{1}{4}$ as long as the body ; middle and hind legs short. Claws unlike on all legs. Anterior and posterior margins of fore wing more or less parallel, the apex rounded ; cubito-anal region poorly developed, fork of radial 4 and 5 extending half-way to wing root, whole fork sagged to rearward ; cross-veins scanty and extremely fine. Whole length of posterior margin of wing ciliated. Hind wing entirely absent.

Nymph not known.

Genotype *I. purpurea* sp. n.

Isca purpurea sp. n. (figs. 15–22, wing, head and genitalia).

Male imago (in fluid). Head generally dark brown ; eyes orange brown, rather paler round the sides, lower portion blackish purple ; lateral ocelli white, median ocellus grey ; antennae dark brown. Notum dark mahogany brown ; mesonotum bearing a single, incomplete, median and two diverging, lateral, buff streaks ; metasternum concolourous with abdominal sternites. Abdomen dark brown ; tergites darker along posterior borders ; sternites uniform dark brown ; posterior half of 9th sternite cream. Genitalia (figs. 19, 20) brownish pink. Forceps scarcely tapered ; basal joint forming more than $\frac{3}{4}$ of total forceps length ; inner margin swollen at base of middle third and also bent inwards sharply at this point ; middle joint somewhat elongate, its separation from other two joints well defined ; terminal joint globular, and no less thick than preceding joint. Penes closely appressed at base, diverging distally, but the tips turned in sharply at apex ; broad at base, tapering evenly to apex, distal two-thirds with a marked inward, spiral twist ; inner surface of penis tip has 5–6 fine dentations. Tails long, cream, with brown basal annulations. Legs generally dark brown ; middle third of femora paler, fore tibia pinkish brown, fore tarsus and claws colourless. Proportions of fore leg, femur : tibia : tarsus 2 : 6 : 5 ; middle leg 4 : 3 : 1 ; hind leg $4\frac{1}{2}$: 4 : $1\frac{1}{2}$. Fore tarsal joints 1 : 18 : 15 : 9 : 2. Wings (fig. 15), translucent pinkish brown, darker in costal and subcostal areas, main longitudinal veins dark brown ; cross-veins entirely absent from tip and periphery, none before bulla, which contains 6–7 simple veinlets ; posterior margin of wing clothed with fine hairs extending from just below apex to wing root, longest in the cubito-anal region.

Female imago (in fluid) : Head and antennae dark brown ; eyes black, ocelli grey. Thorax and abdomen dark brown ; sternites rather lighter. Subanal plate (fig. 21) with two rounded lobes and deep dividing cleft. Tails and wings as in male. Legs : fore femur dark brown with pale central area, tibia and tarsus rather darker, other legs dark brown ; demarcation of mid tarsal joints indistinct, proportions of fore femur : tibia : tarsus 35 : 30 : 13 ; middle leg 30 : 30 : 13 ; hind leg 44 : 40 : 14 .

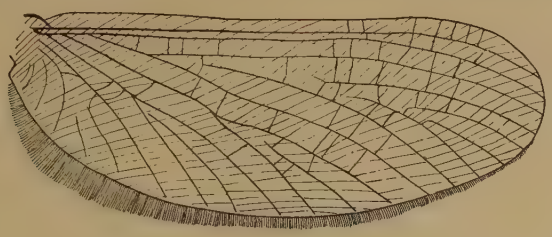
The *subimago* (in fluid) has semi-opaque dark brown wings and a darker body than the imago.

Body length : male 5 mm., female $4\frac{1}{2}$–5 mm. Wings : male $4\frac{1}{2}$ mm., female 4–$4\frac{1}{2}$ mm.

Hong Kong : From two mountain streams near San Wai and Fan Ling, 15–20 miles inland from Kowloon, mostly from the upper reaches of the little river " Chenab " round " Birds Hill," 15th–30th March, 1947. The material includes the male and female types, 8 males and 3 females and 8 subimagines, many of them fragmented.

India : Mirik, N. Bengal, from a mountain stream, altitude 4000 ft. One male imago, 20th September, 1946.

No live specimens were found. The material was collected from cobwebs and from a few spent specimens on the surface of pools. In fresh and dried specimens the wings and body have a marked purple sheen. The Bengal specimen has rather darker eyes, but in other respects is very similar to the



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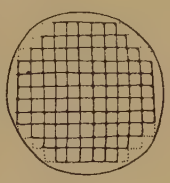

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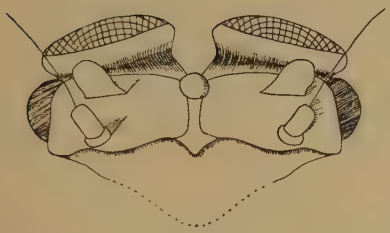

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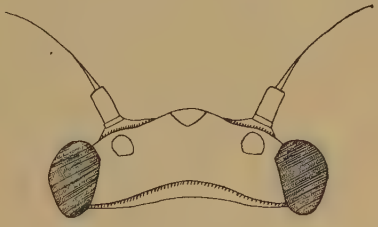

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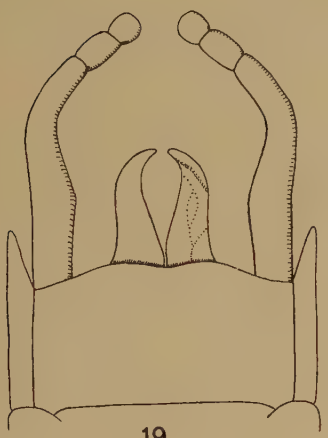

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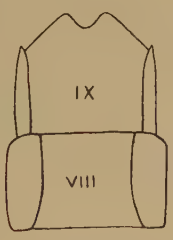

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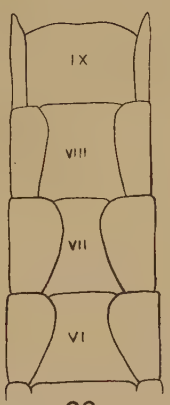

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FIGS. 15–22.—*Isca purpurea* (imago), (15) Fore wing; (16) Diagram of arrangement of facets in ♂ eye; (17) ♂ head (from in front and slightly below); (18) ♀ head (from above); (19) ♂ genitalia; (20) Tip of penis; (21) ♀ terminalia; (22) ♂ venter.

type material. In the absence of any further examples it was thought better to include it in the same species.

The exact position of this genus presents some difficulties. At first sight the absence of hind wing, persistence of cilia in the imago and possible nocturnal habits suggests a certain nearness to the CAENIDAE. The wing of *Leptohyphes*

Eaton is generally similar to *Isca*, although in the latter cubital 2 at its base is quite distinct from, and is not braced against, anal 1. In addition, in certain species of *Leptohyphes* the hind wing has not been lost. *Leptohyphodes* Ulmer (1919) differs markedly in possessing fused plate-like penes. The predominance of the abdominal tergites over the sternites in the construction of the abdomen in *Isca* is not a common feature in Ephemeroptera. The venation of the fore wing, however, is typical of the LEPTOPHLEBIIDAE, and the well differentiated genitalia and unfused penes in the male and presence of a subanal plate in the female are also features characteristic of this family. The complete absence of hind wing distinguishes *Isca* from all others of the family except *Hagenulopsis* Ulmer and *Hagenulodes* Ulmer. The former, from Brazil, has colourless wings, and the female a well-developed ovipositor. The latter, from the Seychelles, has very numerous cross-veins and the forceps are but two-jointed The very clear division of the compound eyes in the male of *Isca* with relatively few, large facets would not seem to be a feature typical of most members of this family, although it is not without interest to note Ulmer's observation that the upper portion of the male eyes of *Hagenulopsis* is almost turbinate as in the BAETIDAE.

In conclusion it seems best to consider *Isca* as an aberrant member of the LEPTOPHLEBIIDAE, and one which may have a wide distribution in the Oriental region.

SUMMARY.

This paper is a further record of material collected during military service in several areas of the Oriental region in the years 1945–47. In a previous paper (1949) I dealt with the BAETIDAE and gave some brief general notes on Oriental Ephemeroptera. Notes are given here on two species belonging to the POLYMITARCIDAE and five LEPTOPHLEBIIDAE including two new genera and five new species.

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SOME COLLEMBOLA FROM MALAYA.*

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The material recorded in this paper was obtained with the aid of a set of my extraction apparatus by Mr. M. W. F. Tweedie, of the Raffles Museum, Singapore, to whom I take this opportunity of expressing my thanks for making this most interesting collection available to me for study. The species described as new under the name *Xenylla malayana* was sent to me by Mr. J. R. Audy, Kuala Lumpur, to whom also I should like to express my thanks.

This paper describes twelve new species and one new genus, as well as recording the following known species from Singapore Island :

Protanura spinifera Carp.
Folsomides parvus Folsom.
Folsomides stachi Folsom.
Folsomina onychiurina Denis.
Pseudentomobrya proxima (Folsom).
Pseudosinella octopunctata Börner.
Cyphoderis assimilis Börner.
Neelus murinus Folsom.
Megalothorax minimus Folsom.

The species *Pseudentomobrya proxima* was first described by Folsom in the genus *Pseudosinella*, but he later transferred it to *Entomobrya*. I am of the opinion that the species should now be placed in the genus *Pseudentomobrya* Salmon, 1941.

The most interesting discovery in Mr. Tweedie's collection was a new species belonging to the genus *Clavontella*, which I erected in 1944 for the reception of four New Zealand species of Collembola. This species from Malaya is the first record of the genus outside New Zealand, and is further evidence in support of the zoogeographical affinities already so strongly shown by these insects between New Zealand and the Indo-Malayan Region.

Types of new species are held in my own collection, and a series of Paratypes has been deposited with the Raffles Museum, Singapore.

Arthropleona.

Hypogastruridae.

Hypogastrurinae.

Xenylla Tullberg.

Xenylla malayana sp. n. (figs. 1–4).

Colour : Deep blue-black.

Clothing : Sparsely clothed with short simple setae, slightly longer posteriorly.

Body : Length up to 1 mm. Antennae about $\frac{2}{3}$ as long as head ; segments III and IV fused, the ratio of segments being 20 : 25 : 70. Ant. IV apically with a single protrusible knob alongside a finger-like process ; subapically with 4 stout curved sense rods, 3 of which are together with the 4th somewhat removed. Sense organ of ant. IV with 2 short sense clubs behind strong integumentary fold, which itself is flanked on either side by a strong curved sense rod, the whole guarded by 2 strong setae. Numerous setae both curved and straight clothe the antennae. Ocelli 5 to each side, subequal, the ocellar patches black.

* This paper was completed during the author's tenure of a Nuffield Fellowship in London.

Anal spines very small and on minute papillae. Rami of tenaculum each with 3 barbs. Cuticle coarsely granulate.

Legs : Claw with strong inner tooth at from $\frac{1}{3}$ to $\frac{2}{5}$ down and a pair of small outer lateral teeth at about $\frac{2}{5}$ down. Claw distinctly granulate, with a moderately long curved basal seta to each side. A single faintly clavate tenent hair, about as long as claw, to each foot.

Furcula : Mucro half as long as dens, distinctly upturned apically, with narrow median lamella from base to tip and broad lateral lamella from base to about $\frac{3}{4}$ down. Dens with 2 long posterior setae. Manubrium and dens more finely granulate than body ; manubrial " hooks " distinct.

Locality : MALAYA : Kuala Lumpur, in leaf mould taken from axils of oil palm fronds.

Remarks : This species is close to *X. sensili* Folsom from Hawaii, and differs mainly in the number and form of the tenent hairs.

ACHORUTINAE.

Pseudachorutini.

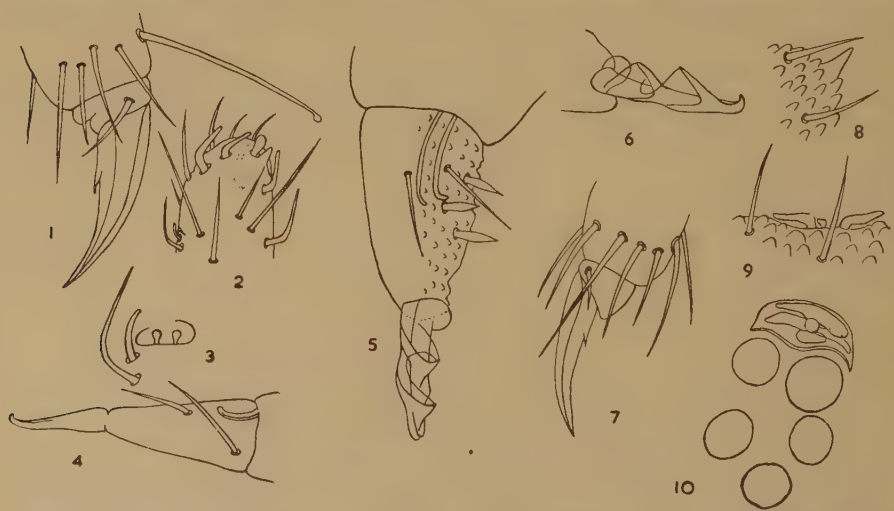
Clavontella Salmon.

Clavontella trispina sp. n. (figs. 5–10).

Colour : Mottled clear violet to bluish violet, paler ventrally and on the legs and furcula. Ocelli on deeper blue patches.

Clothing : Of occasional short plain setae, more numerous posteriorly.

Body : Length up to 1 mm. Antennae almost as long as head with segments III and IV fused ; the 3 segments related as 25 : 25 : 55. Ants. III and IV with 2 straight, slender, apical sensory setae ; a pair of minute sub-apical sense clubs behind a cuticular fold ; a large ventral group of numerous short, curved, stumpy sense rods ; a pair of stout ventral sub-apical straight sense rods ; a group of 5 dorsal, curved, sub-apical stout sense



FIGS. 1–4.—*Xenylla malayana* sp. n. (1) foot ; (2) apex of ant. IV ; (3) sense organ ant. III ; (4) mucrodens.

FIGS. 5–10.—*Clavontella trispina* sp. n. (5) Dens and mucro ; (6) mucro ; (7) foot ; (8) anal spine ; (9) sense organ ant. III ; (10) ocelli and postantennal organ.

rods and numerous moderately long setae. Sense organ of ant. III situated behind integumentary fold and consisting of 2 very stout tapering right-angled sense rods in the centre, flanked on each side by a stout curved sense rod lying along the cuticular fold. Ocelli 5 to each side, subequal. Postantennal organ in a deep narrow rectangular pit extending across front of ocellar field, and formed of a central boss with 4 irregularly shaped, unequal, peripheral lobes that more or less fill the pit. Anal spines 2, very small, about twice the size of a cuticular tubercle, and situated on very small papillae that are marked by their very fine granulations. Rami of tenaculum each with 3 barbs.

Legs : Claw with basal inner tooth about $\frac{1}{5}$ down, no outer teeth ; a short basal seta to each side of claw. Claw surrounded by 10 stout tenent hairs, which may or may not be faintly clavate, and which are arranged as 2 anterior, 3 lateral to each side and 2 posterior overhanging the inner margin of the claw (fig. 7). Unguiculus absent. Claw base finely granulate.

Furcula : Short, dens and mucro subequal, the dens tuberculate and granulate, mucro very finely granulate. Dens with 3 typical posterior spines, 1 long posterior basal seta and 1 short lateral seta. Mucro broad, spathulate, with small sharply upturned apex, 2 prominent, backwardly sloping, teeth at $\frac{1}{3}$ and $\frac{2}{3}$ respectively, and a smaller, inner, basal, granulated lamella. The 2 large teeth arise abruptly on the inner edge, but curve away gracefully along the outer edge of the mucro ; they are joined by a delicate curved lamella. Inner edge of mucro finely granulate. Manubrial hooks present.

Locality : Singapore : McRitchie Reservoir, in damp leaf mould at base of tree.

Isotomidae.

Isotominae.

Isotomini.

Parisotoma Bagnall.

Parisotoma canituda sp. n. (figs. 11–14).

Colour : Light bluish grey, granulated, paler ventrally and on legs and furcula ; ocellar fields deep blue-black ; antennae pale violet deeper towards apex.

Clothing : Of short simple setae, generally rather sparse on both body and appendages except around posterior, where they are longer and more numerous.

Body : Length up to 0·65 mm. Antennae a little longer than head, on raised bases, the 4 segments related as 6 : 8 : 7 : 13. Ant. IV with apical sensory dome, numerous short simple setae and curved sensory hairs and 3–4 subapical curved sense rods. Sensory organ on ant. III consisting of 2, short, stout, exposed sense rods, each in an individual socket, the one slightly above the other. Six large ocelli to each side, subequal. Postantennal organ large, elliptical, the anterior edge straightened and double outlined, the whole 2 to $2\frac{1}{2}$ times as long as broad and $2\frac{1}{2}$ to 3 times as long as the adjacent ocellus. Abd. IV almost $\frac{1}{2}$ as long again as abd. III. Rami of tenaculum each with 4 barbs. the corpus with a long stout seta.

Legs : Claw rather short and stout, gently curved and without any teeth. Unguiculus short, slightly curved, lanceolate, with broad straight outer lamella and very broad curved inner lamella. A single, short, non-clavate tenent hair to each foot and a slender, rather long basal seta to each side of claw.

Furcula : Dens and mucro completely fused ; the mucro-dens a little shorter than manubrium, with 4–5 coarse crenulations, 4 posterior setae, 2 postero-lateral setae and 2 antero-lateral apical setae. Mucro bidentate, with small apical and larger sub-apical tooth extending along inner side of mucro as a prominent lateral ridge.

Locality : Singapore : McRitchie Reservoir, in fibrous roots and dead vegetation ; Stevens Road, Singapore, in leaf mould in large bracket fungus.

Mydoniidae.

Mydoniinae.

Mydoniini.

Acanthocyrtus Handschin.

Acanthocyrtus hamatus sp. n. (figs. 15–17).

Colour : Creamy white to deep ochreous with generally some diffuse light blue shading on sides of abds. IV and V and on the legs, more especially the femurs of the hind legs. Antennae bluish-violet deepening towards tips, ocelli on dark bluish-black pigment patches.

Clothing : Of faintly striated hyaline scales and short ciliated setae, more numerous posteriorly. A group of long slender simple bristles at apex of mesotergum.

Body : Length up to 2·8 mm. Antennae twice as long as head, the segments related as 7 : 17 : 12 : 24. Ocelli 8 to each side, 6 long and 2, the posterior inner 2, much smaller. Abd. IV 4–6 times longer than abd. III. Rami of tenaculum each with 4 barbs ; corpus very large, naked. Antennae not scaled ; ant. IV without apical knob, but heavily clothed with short ciliated setae and short plain sensory setae. Setae of basal antennal segments ciliated and longer.

Legs : Trochanteral organ consists of many short sharp spines ; legs heavily clothed with long ciliated setae. Claw and unguilicus finely granulate. Claw with a pair of strong inner teeth at centre and a single strong distal tooth at $\frac{2}{3}$ down, a single outer basal median tooth and a pair of outer, lateral, basal teeth just below it. Unguiculus lanceolate, reaching to just beyond distal tooth of claw and with its outer edge along its entire length bearing 10–12 fine teeth, giving it a barbed appearance. A single, slender, non-clavate, tenent hair, about half as long as claw, to each foot.

Furcula : Manubrium only slightly longer than dens, with a group of spines and cilated setae distally on its posterior face ; dens posteriorly with several rows of spines and ciliated setae, scaled anteriorly, annulated and corrugated. The spines of dens and manubrium finely ciliated towards their tips. Mucro bidentate with basal spine, the subapical tooth just a little bigger than the apical, the basal spine reaching to its tip. Mucro as long as the uncorrugated portion of the dens, which is carried over to base of the subapical mucronal tooth as a finely serrated lamella. The base of the basal spine provided with an additional small minute spine. Mucro surrounded by long ciliated setae.

Locality : Singapore : Catchment Area Jungle, in leaf mould.

Remarks : Owing to the ciliated nature of the spines of the dentes this species may require a new genus to receive it, but until more related species are found I prefer to leave it in the genus *Acanthocyrtus*.

Trichogaster Handschin.

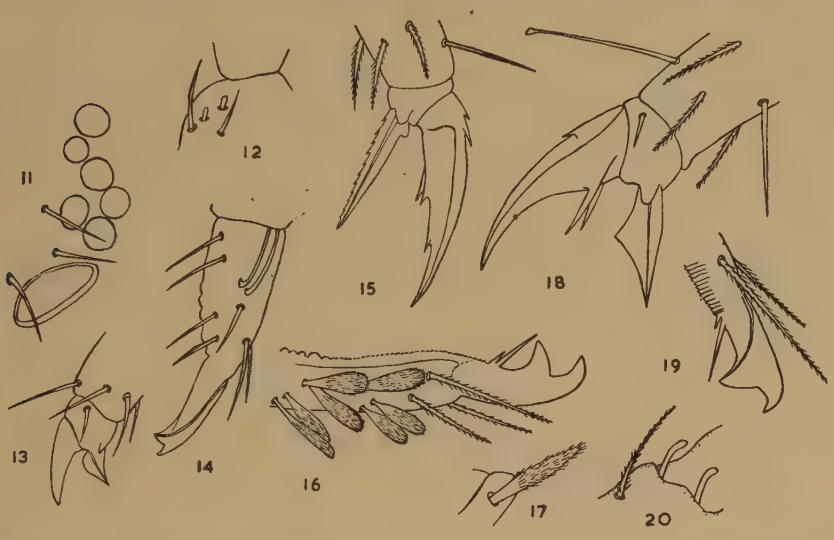
Trichogaster caerulea (figs. 18–20).

Colour : Entirely medium to deep blue, paler on legs and furcula and around intersegmental margins, deeper on antennae.

Clothing : Of hyaline scales and short ciliated setae, the latter more numerous posteriorly and on the legs, furcula and antennae. Dens with scales, legs and antennae without scales.

Body : Length up to 0·5 mm. ; the mesothorax somewhat swollen, bulbous. Antennae only slightly longer than head, the 4 segments stout, and related as 15 : 25 : 27 : 47. Ant. IV with both ciliated and plain setae, but no apical sense organ. Ant. III with a pair of curved sense rods behind integumentary fold. Ocelli large, subequal, 6 to each side. Rami of tenaculum each with 4 barbs ; corpus with a long, stout, subapical, anterior seta. Abd. IV 5 times longer than abd. III.

Legs : Claw with a pair of outer, lateral, basal teeth and a pair of long needle-like inner teeth arising just beyond base and extending half-way down claw ; remainder of claw curved and without teeth. Unguiculus needle-like, about $\frac{2}{3}$ as long as claw, with narrow outer lamella and very broad, inner, angular, truncated lamella. A very short basal seta to each side of claw. A single clavate tenent hair, about as long as claw, to each foot, with opposite on the other face of the tibiotarsus, a single simple seta.



FIGS. 11–14.—*Parisotoma canituda* sp. n. (11) Ocelli and postantennal organ ; (12) sense organ ant. III ; (13) foot ; (14) mucrodens.

FIGS. 15–17.—*Acanthocyrtus hamatus* sp. n. (15) Foot ; (16) apex of dens and mucro ; (17) ciliated spine from dens.

FIGS. 18–20.—*Trichogaster caerulea* sp. n. (18) Foot ; (19) mucro and apex of dens ; (20) sense organ ant. III.

Furcula : Dens slightly longer than manubrium, annulated and corrugated, the uncorrugated portion twice as long as mucro and continuing as fine serrations to foot of basal spine of mucro. Mucro-dens joint very indistinct ; mucro bidentate with 1 large and 1 small basal spine ; the subapical tooth much larger than the apical, and running along the side of the mucro to the base as a distinct ridge. Mucro surrounded by long ciliated setae.

Locality : SINGAPORE : Catchment Area Jungle, in leaf mould.

Trichogaster fasciata sp. n. (figs. 21–24).

Colour : Orange-yellow, with deep violet pigment between antennal bases along edges of thoracic terga, dorso-laterally around posterior half of abd. II, the whole of abds. III, V and VI ; abd. IV with violet shading laterally and dorso-posteriorly ; the deep pigment of abd. III extending a little on to abd. IV dorsally ; antennae deep violet ; legs ochreous with violet shading, especially on hind legs ; furcula ochreous. Ocelli on deep violet-black pigment patches.

Clothing : Of hyaline scales and occasional short finely ciliated setae ; setae of legs longer. Lasiotrichia present on abds. III and IV.

Body : Length up to 1 mm. Antennae about 1½ times as long as head, the 4 segments related as 12 : 24 : 20 : 42. Ant. IV with many short, curved, ciliated setae and numerous slender curved sense rods ; no apical organ. Ant. III with subapical sense organ consisting of 2 short, stout, curved rods close together behind a low, integumentary fold, with a longer, more slender, curved rod somewhat removed from each end of fold ; the whole guarded by a pair of long curved sense rods. Ant. II with subapical group of 3–4 slender, curved, exposed, sense rods. Ocelli 8 to each side, 6 large subequal and 2, the inner posterior 2, extremely small. Abd. IV 4 times longer than abd. III. Rami of tenaculum each with 4 barbs. Corpus large, stout, with 2 long, plain, stout anterior setae.

Legs : Claw base and unguiculus finely granulate ; claw with a pair of strong outer lateral teeth about ⅓ down ; a pair of very long needle-like interior teeth arising just below base with a further very minute inner tooth at ⅔ down. Unguiculus needle-like, with broad, obtusely truncated inner lamella and narrow outer lamella, a single, faintly clavate tenent hair approximately equal to claw in length to each foot and a very short basal seta to each side of claw.

Furcula : Manubrium a little longer than dens or subequal. Dentes scaled, corrugated and faintly annulated. Postero-laterally with strongly ciliated setae. Corrugations of dens extending on to mucro as a finely serrated lamella about twice as long as mucro. Mucro bidentate with 2 basal spines ; the pre-apical tooth much larger than the apical and over-topped by the longer basal spine ; the other spine much shorter, about ⅓ length of the longer one.

Locality : Singapore : McRitchie Reservoir, among fibrous roots and dead vegetation.

Trichogaster pallida sp. n. (figs. 25–27).

Colour : Ochreous white with pale blue antennae and very pale blue shading on edges of mesothoracic terga and sides of abds. IV and V. Ocelli on deep blue-black pigment patches.

Clothing : Of hyaline scales, short simple and longer ciliated setae, the latter more common on the appendages. Abds. III and IV with several lasiotrichia.

Body : Length up to 2 mm. Antennae half as long again as head, the 4 segments related as 3 : 8 : 6 : 14. Ant. IV without apical organ, but with many short, slender, curved sensory rods among the clothing of short ciliated setae. Ant. III with sense organ of 2 short, stout, curved sense rods close together with a longer, more slender sense rod on each side. Ant. II with sub-apical sense organ of 2 exposed bent sense rods close together and 6–7 longer, more slender, curved sense rods scattered at random in sub-apical region ; ant. I with 1 or 2 short, straight, sub-apical, exposed sense rods. Ocelli 8 to each side, with the posterior inner 2 very small, remainder large, subequal. Rami of tenaculum each with 4 barbs. Abd. IV 4 times longer than abd. III.

Legs : Claw long with a pair of outer teeth at ⅓ down, a pair of inner plate-like teeth at just above centre and a third single inner tooth at about ⅔ down. Unguiculus lanceolate, reaching to second inner tooth : a single clavate tenent hair, about half as long as claw, to each foot. Legs heavily clothed with finely ciliated setae, some of which are very long. Hind trochanters each with a group of short stout spines.

Furcula : Manubrium a little longer than dentes with many slender, finely ciliated setae on anterior face. Dens annulated and corrugated, scaled, and with numerous ciliated setae. Mucro elongate, bidentate, the subapical tooth equal to, or a little larger, than the apical, and with 2 basal spines, the longer of which overtops the sub-apical tooth, the other shorter one being from ¼ to ⅓ the length of the longer spine. Uncorrugated portion of dens about twice length of mucro.

Locality : Singapore : McRitchie Reservoir, among fibrous roots and dead vegetation.

Orchesellini.

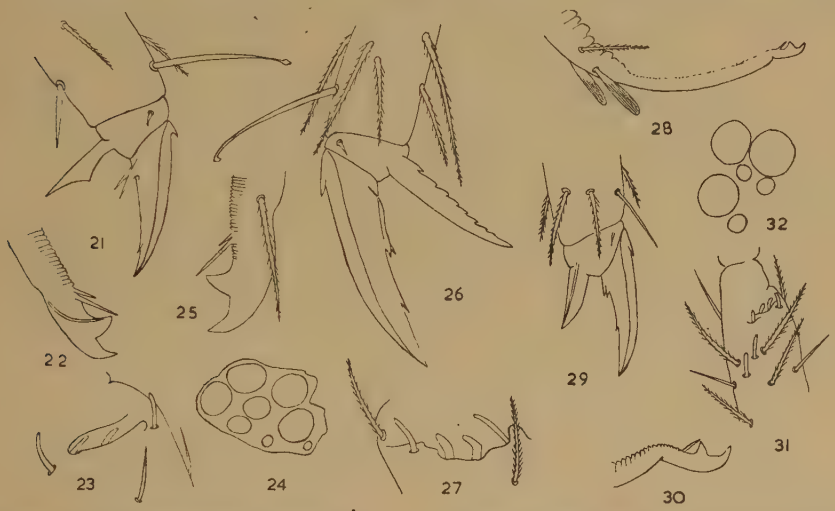
Ptenura Templeton.

Ptenura abrupta sp. n. (figs. 28–32).

Colour : Creamy-white, with sometimes bluish or violet shading latero-ventrally on thorax and abdomen, on front of head and on antennae. Ocellar fields deep blue-black.

Clothing : Of typical scales and short ciliated setae, mainly on posterior region of body, legs, furcula and antennae. Lasiotrichia on abds. III and IV. Ants. I and II and furcula with scales.

Body : Length up to 0·65 mm. Antennae a little over twice as long as head, 5-segmented (ant. I secondarily divided), the segments related as 4 : 14 : 18 : 19 : 68. Ant. V annulated without apical sensory knob or sense rods, but with several apical and subapical



Figs. 21–24.—*Trichogaster fasciata* sp. n. (21) Foot ; (22) mucro and apex of dens ; (23) sense organ ant. III ; (24) ocelli.

Figs. 25–27.—*Trichogaster pallida* sp. n. (25) Mucro and apex of dens ; (26) foot ; (27) sense organ ant. III.

Figs. 28–32.—*Ptenura abrupta* sp. n. (28) Terminal portion of dens and mucro ; (29) foot ; (30) mucro and apex of dens ; (31) sense organs ant. IV ; (32) ocelli.

simple sensory setae in addition to the ciliated setae. Subapical sense organ of ant. IV consisting of 2 stout, bent sense rods, behind an integumentary fold with a straight, exposed sense rod on one side and a shorter, straight sense rod, behind its own integumentary fold, on the other side ; below this a pair of large stout, exposed sense rods. Ant. III subapically with 2 or 3 short, stout, spine-like setae. Ocelli 6 to each side, the anterior pair very much larger than the remainder, of which the posterior outer is large, and the remainder small, subequal. Abd. IV half as long again as abd. III. Rami of tenaculum each with 4 barbs ; corpus with a very stout apical seta.

Legs : Claw with a pair of extremely small exterior lateral basal teeth ; inner margin straight to $\frac{1}{5}$ down, where it bears a pair of blunt teeth, thence curved with sometimes a single small tooth at centre. Unguiculus lanceolate, about $\frac{1}{2}$ as long as claw, rather truncate on inner margin. A single non-clavate tenent hair, slightly shorter than claw, to each foot. A short basal seta to each side of claw.

Furcula : Dens half as long again as manubrium, annulated and corrugated, narrowing abruptly about $\frac{2}{3}$ down, the corrugations and annulations becoming extremely fine on this narrowed portion and passing as a serrated lamella on to mucro. Mucro-dens joint indistinct or absent ; mucro short and stout, bidentate with basal spine, the 2 teeth subequal. Dens subapically with 2 or 3 long ciliated setae.

Locality : Singapore : Catchment Area Jungle in leaf mould.

Symphypleona.

Sminthuridae.

Sminthurinae.

Sminthurini.

Sphyrotheca Börner.

Sphyrotheca biniserrata sp. n. (figs. 33–36).

Colour : Pale to medium bluish-violet ; antennae deeper violet.

Clothing : Three plain bothriotrichia on each side of larger part of body and 2 on each side of genital area. Simple, moderately long setae rather sparse dorsally and anteriorly, more numerous posteriorly. Setae of legs and furcula plain, but hind tibiotarsi on inner edge each with 2 very stout " bi-serrated " setae (fig. 33).

Body : Length up to 0·44 mm. Antennae $1\frac{1}{2}$ times as long as head, the 4 segments related as 20 : 34 : 30 : 90. Ant. III with sense organ of two subapical sense clubs each in its own pouch. Ant. IV with 7–9 indistinct subdivisions and apically projecting as a finger-like structure with apical knob, 2 short apical sense rods, 1 short subapical sense rod and 3–4 long curved sense rods. Ocelli 6 to each side, all large and dark blue pigmented. Rami of tenaculum each with 3 barbs.

Legs : Claw long and slender, with a pair of outer lateral teeth at about $\frac{1}{3}$ or centre, and a single inner tooth at approximately $\frac{3}{4}$ down. Unguiculus lanceolate, about $\frac{1}{2}$ as long as claw, and projecting into a filament which over-reaches claw tip on middle and front feet, but is very short on hind feet. A single short lateral basal seta to each side of claw. No tenent hairs.

Furcula : Manubrium ; dens ; mucro as 25 : 75 : 40. Dens with constriction at $\frac{1}{3}$ from base. Dens around apex with several simple curved setae on anterior face, but on posterior face with a row of 3–4 strong spine-like setae. Mucro long and tapering with an indentation just beyond centre on posterior side, slightly recurved at tip and with outer lamella irregularly plain and inner lamella serrated, more coarsely so from base to indentation.

Locality : Singapore : Stevens Road, in leaf mould in large bracket fungus and in rotten wood from a fallen tree.

Parasphyrotheca gen. n.

Of similar facies to *Sphyrotheca*, but with strong spine-like setae on the dorsum and stout spines on top of the head. The spines and spine-like setae either plain or finely serrated. Two lasiotrichia present on the furcal segments, 3 on the larger part of the body.

Genotype : *Parasphyrotheca magnificata* sp. n.

Parasphyrotheca subfusca sp. n. (figs. 37–40).

Colour : Pale brown to creamy white ; antennae and legs cream to white.

Clothing : Long simple setae with spine-like setae on top of head in both males and females ; males with spine-like setae on sides and dorsum of body as well.

Body : Length up to 0·5 mm. Antennae 4-segmented, the segments related as 10 : 14 : 30 : 76. Ant. IV with 13–14 subdivisions, marked by whorls of setae ; apically with a finger-like process and 6–7 straight sense rods ; subapically with a very long, stout, strongly bent sense rod. Sense organ of ant. III subapical, and typically of 2 sense rods each in its own pouch and protected by 3 guard setae. One ocellus to each side. Rami of tenaculum each with 3 barbs.

Figs. 33–36.—*Sphyrotheca biniserrata* sp. n. (33) Serrated setae on hind tibiotarsus ; (34) foot ; (35) apex of antenna ; (36) mucro and apex of dens.

Figs. 37–40.—*Parasphyrotheca subfusca* sp. n. (37) Sense organ ant. III ; (38) apex ant. IV ; (39) mucro and apex of dens ; (40) foot.

Figs. 41–44.—*Parasphyrotheca magnificata* sp. n. (41) Sense organ ant. II ; (42) sense organ ant. III ; (43) mucro and apex of dens ; (44) foot.

Figs. 45–47.—*Parasphyrotheca fasciata* sp. n. (45) Serrated spine-like seta from dorsum ; (46) foot ; (47) mucro and apex of dens.

Legs : Claw and unguiculus both granulate. Claw long sickle-like, wide at base with outer tooth about $\frac{1}{3}$ down and single inner tooth on middle and hind feet only at about centre. A very short stumpy lateral basal seta to each side of claw. No tenent hairs. Unguiculus lanceolate, from $\frac{1}{2}$ to $\frac{2}{3}$ as long as claw, slightly curved, and with long, whip-like extension reaching beyond claw tip on all feet, though shorter on hind feet.

Furcula : Manubrium to dens to mucro as 35 : 41 : 18. Mucro long, boat-like and trilamellate, the middle lamella plain, inner crenulate, outer serrate. Dens with 3 apical

spines, 1 being posterior and 2 lateral; several setae on both anterior and posterior faces, and 4–6 lateral spine-like setae.

Locality: Singapore: McRitchie Reservoir, in fibrous roots and dead vegetation.

Parasphyrotheca magnificata sp. n. (figs. 41–44).

Colour: General ground-colour ochreous on the head and orange on the body, with deep violet shading dorsally and bluish-black shading ventrally. Head shaded with pale violet laterally and anteriorly. Legs and antennae yellow with blue bands around each segment; claws colourless; furcula with the manubrium yellow shaded distally with pale violet; dens deep violet, mucro very deep violet. Ocelli deep violet on black ocellar fields.

Clothing: Long stout plain spines on the head and similar spine-like setae on the body; numerous moderately long simple setae on anal and furcal segments, legs, antennae and furcula. The spines on the head equal to the mucro in length.

Body: Length up to 1·2 mm. Antennae slightly longer than head, the 4 segments related as 18 : 28 : 35 : 70. Ant. IV subdivided into 13 divisions, each with a whorl of long curved simple setae and, apically, with finger-like process and 5–6 straight sense rods. Subapical sense organ of ant. III consisting of 2 sense rods side by side, each in its own pouch with, slightly removed, a stout sensory spine and guard seta; a single guard seta arises between the 2 sensory rods. Ant. II with an apical pair of unequal exposed sense rods. Ocelli 8 to each side. Rami of tenaculum each with 3 barbs; corpus elongate, with 3 apical spines. On ventral surface of abdomen between tenaculum and base of furcula are 2 stout simple papillae.

Legs: Claw without any inner teeth, but with a pair of small outer basal teeth and a prominent tunica; a small basal seta to each side of claw; both claw and unguiculus finely granulate. Unguiculus lanceolate, sharply pointed, about ½ as long as claw with broadly spathulate subapical bristle extending beyond apex of claw. Tenent hairs absent.

Furcula: Dens faintly crenulate posteriorly and bearing apical girdle of 6–7 setae of which the posterior is extremely long and overlays the mucro; there are 3 needle-like spines with broad bases and 3–4 basal setae on posterior face. Mucro finely granulate, the lamellae plain, the apex rounded, bulbous, and with a transverse row of fine teeth around the anterior face near the base.

Locality: Singapore: McRitchie Reservoir, in damp leaf mould at base of tree.

Parasphyrotheca fasciata sp. n. (figs. 45–57).

Colour: Creamy-white, with 3–4 broad deep violet transverse bands across large part of body and irregular violet blotching on sides. Head pale violet, antennae deep violet, legs pale violet, furcula and ventral body surface whitish. Ocelli on deep blue-black patches.

Clothing: Of simple setae and long spine-like, finely serrated setae on dorsum and similar but shorter spines on top of head. Three lasiotrichia on large part of body and 1 on genital segments.

Body: Length up to 0·9 mm. Antennae a little over twice as long as head diagonal, the 4 segments related as 3 : 5 : 9 : 26. Ant. IV with 12 divisions, each marked by whorls of setae; apically with several straight sensory setae. Sense organ of ant. III typical as in *P. magnificata*. Ocelli 6 to each side, subequal. Rami of tenaculum each with 3 teeth; corpus with prominent extension between the rami, which is terminated by 4 short, curved, simple setae.

Legs: Claw with tunica, a pair of small outer teeth about ⅓ down and a single inner tooth at about centre. A short basal seta to each side of claw. Unguiculus lanceolate,

about ½ as long as claw with long terminal filament overreaching claw tip, especially on front feet. Claw and unguiculus both finely granulate. No tenent hairs.

Furcula : Dens approximately 2½ times length of mucro. Mucro finely granulate, boat-shaped, the inner lamella crenulate, the outer plain, with a niche at the centre, or ⅔ down. Dens with apical girdle of 5–6 spine-like setae, 1 ventral long apical seta, 3 ventral setae and 2 lateral spines on inner surface, the one subapical the other at ⅓ down. No spines on outer surface of dens, but usually there are 3 to 4 setae on the anterior face.

Locality : Singapore : Catchment Area Jungle, in leaf mould at base of tree.

Summary.

Twelve new species and one new genus are described, and nine previously known species are recorded from Singapore Island for the first time.

Book Notices.

Insects of North Carolina : Second Supplement. By David L. Wray, Ph.D. 8vo. Rayleigh, N.C. (North Carolina Dept. of Agriculture), 1950. Pp. 59. One map.

This continues the work of C. S. Brimley, who compiled the original work and its first supplement. Additions have been made to all groups, but in most of the larger Orders little correction of the existing lists has been attempted.

Besides Insects, the List includes Arachnida, Diplopoda, Chilopoda, Symphyla and Pauropoda.

A Monograph of the Collembola, or Springtail Insects, of New York State. By Elliott A. Maynard. 8vo. Ithaca, New York (Comstock Publishing Company). 1951. Pp. xxii + 339, 37 pls. (3 col.), 669 figs. Price $7.50.

This is a straightforward systematic account beginning, after a general introduction, with a key to sub-orders, and working down through a succession of keys, to species. Each species is given full synonymy and a very complete list of references by previous authors. These are abbreviated, but may be followed up by means of a very extensive, 40-page Bibliography of the Collembola of the World. Besides a description and an account of distribution for each species there is a *Discussion* which is sometimes extensive and detailed.

Three of the plates (two on Sminthuridae) are in colour.

OBSERVATIONS ON THE GENUS *BRUNETTIA* ANNANDALE (DIPT., PSYCHODIDAE), WITH DESCRIPTIONS OF TWO NEW SPECIES.

By Paul Freeman.

(*British Museum, Natural History.*)

Since the publication of Dr. Satchell's recent paper (1950) on the Psychodids of Fiji, a male of a new species from Fiji, allied to *Brunettia biformis* Edwards, has been sent to the British Museum. The species is interesting in itself, but when examined in conjunction with a specimen of another new species already in the British Museum from India, it gives an opportunity for some discussion on the generic diagnosis of both *Brunettia* and *Telmatoscopus*.

Brunettia was erected by Annandale in 1910 to receive the species *B. superstes* Annandale and others. The generic diagnosis mentions the broad, thickly-scaled wings, characters of venation and mouth parts, 15-segmented antennae, emarginate eyes, and the presence of numerous racket-shaped spinules on the cercopods. Species described later and placed in this genus dispose of these characters quite easily. For instance, the Indian *B. albonotata* Brunetti and African species described by Tonnoir (1939) have hairs and no scales on the wings; Tonnoir placed these in a subgenus *Trichobrunettia*. *B. biformis* Edwards from Fiji and Samoa has venation differing in the branching of Rs. The African species, *B. obscura* Tonnoir, has eyes which are hardly emarginate and certainly have no eye bridges; this and other species described in the same paper (1939) have 16-segmented antennae, and the cercopods of *B. obscura* lack the racket-shaped spinules.

Tonnoir (1933 : 70) mentions Eaton's original diagnosis of *Telmatoscopus* and says that only the antennal characters are of importance. These are as follows: antennae 16-segmented, flagellar segments each with a bulbous basal portion and a distal more or less elongate neck, the last few segments being similar to the others and not diminutive or indistinctly articulated, each segment with long verticils forming a cup around the segment; several basal segments eccentric.

It is quite clear that this diagnosis is imperfect. On the one hand Palaearctic species of the subgenus *Panimerus* have segments with quite short necks and no basal segments eccentric, on the other hand a number of species of *Brunettia*, including *B. unipunctata* sp. n., fit this diagnosis perfectly. Added to this, species of *Pericoma* falling into the group *Ulomyia* have reasonably good necks to a number of the segments though the basal bulb is not eccentric. There are also a number of Palaearctic species of *Telmatoscopus* with 15-segmented antennae.

The antennae of *Brunettia* may be formed of fusiform segments as in *Pericoma* (e.g., *B. sapphirina* Edwards from Sumatra), or of bead-like segments (*B. splendens* Tonnoir from Africa), or of segments with eccentric bulb and long neck just as in typical *Telmatoscopus* (e.g., *B. unipunctata* sp. n.); intermediate stages exist between these three forms. Tonnoir (1939) in his key to the African genera mentions only one character to separate *Brunettia* from *Telmatoscopus*—the presence of hairs or scales upon the wing membrane in

Brunettia and their absence in *Telmatoscopus*. However, the new species, *B. infurcata*, makes even this character difficult to apply.

The logical conclusion would seem to be that *Pericoma*, *Brunettia* and *Telmatoscopus* form an intergrading series, possibly in an active state of evolution with many intermediates still remaining, and that they should not have more than a subgeneric status. This conclusion is not very acceptable because the bulk of the species fall fairly readily into one or other of these three main groups, and I am proposing to retain them in their present form, but to offer the following revised diagnosis of *Brunettia* :

Brunettia Annandale.

Brunettia Annandale, 1910, *Rec. Indian Mus.* **5** : 141.
Parabrunettia Brunetti, 1911, *Rec. Indian Mus.* **6** : 311.

Antennae 15- or 16-segmented, segments of flagellum varying, either fusiform, then without cupuliform verticils, or segments may have a basal bulb and well-developed neck as in *Telmatoscopus*, with bulb often eccentric; these species have cupuliform verticils; apical segments alike, not reduced; ascoids a pair of simple spines which may be curved or twisted; eyes usually with bridges; wings typically covered with broad overlapping scales arising from both membrane and veins, these may be replaced in some species either entirely or in part by hair, or the area covered by scales may be drastically reduced so that they are present only in anal and humeral regions; male cercopods usually with racket-shaped hairs as well as, or in place of, normal retinacula.

Genotype : *Brunettia superstes* Annandale, fixed by Brunetti, 1911.

Tonnoir erected the subgenus *Trichobrunettia* (1939 : 74), type *B. albonotata* Brunetti, for those species with the scales on the wings largely or entirely replaced by hairs. In my opinion there are too many intermediate or doubtful forms for this to stand.

Brunettia unipunctata sp. n.

A large dark species with scales confined to basal half of lower surface of wing; separable from *B. biformis* Edwards by the reduction of the wing scales and by the presence of only one white wing spot, at the tip of R_4; wings of male (female not known), truncate, anal area enlarged, hair pocket between M_4 and Cu; antennal segments with long necks.

Male.—Wing length, 3·5 mm.

Head.—Vertex and upper part of face with dark scales, lower part of face and mouthparts including palpi with snowy white scales. Eye-bridges well developed, point of union difficult to see in the unique specimen, but they probably do meet or nearly. Antennae 15-segmented, flagellar segments with well-developed necks and eccentric basal bulbs, apical segment with well-developed neck (fig. 1*b*); ascoids long and curved, present in pairs on segments 2–12 of flagellum; verticils cupuliform, present on all flagellar segments including the last.

Thorax.—Cuticle pitchy, clothed with dark hairs; scutellar hairs greyish; area around anterior spiracle swollen and densely clothed with black scales.

Legs.—Brown, clothed with greyish scales, small white scale patch present at extreme tips of all tibiae and all metatarsi.

Wings.—Appearance characteristic (fig. 1*a*); anal and humeral regions expanded, apex truncate; veins compressed, making their courses difficult to follow basally, Rs pectinately branched, stem of posterior fork very short, area between apical half of M_4 and Cu widened and slightly bulged so as to make a depression on the ventral surface. Upper surface clothed all over with brown hairs arising from both veins and membrane; scales absent from upper surface except at extreme base, where some are borne on the

thick veins; a single snowy white spot present at tip of R_4, fringe brown. Lower surface clothed with brown hairs and brown scales; scales confined to veins and membrane of basal half of wing except for a few mixed with hairs along centres of cells R_2 and R_3; depression between M_4 and Cu lined with long hairs arising around Cu and lying at right angles to normal direction; another row of long hairs arises between M_3 and M_4, again lying at right angles to normal direction, and forms a roof to the depression; whole organ visible to naked eye as a dark mark on the wing. Alula with large tuft of very long scales (fig. 1*a*), whitish above and black below. Halteres black.

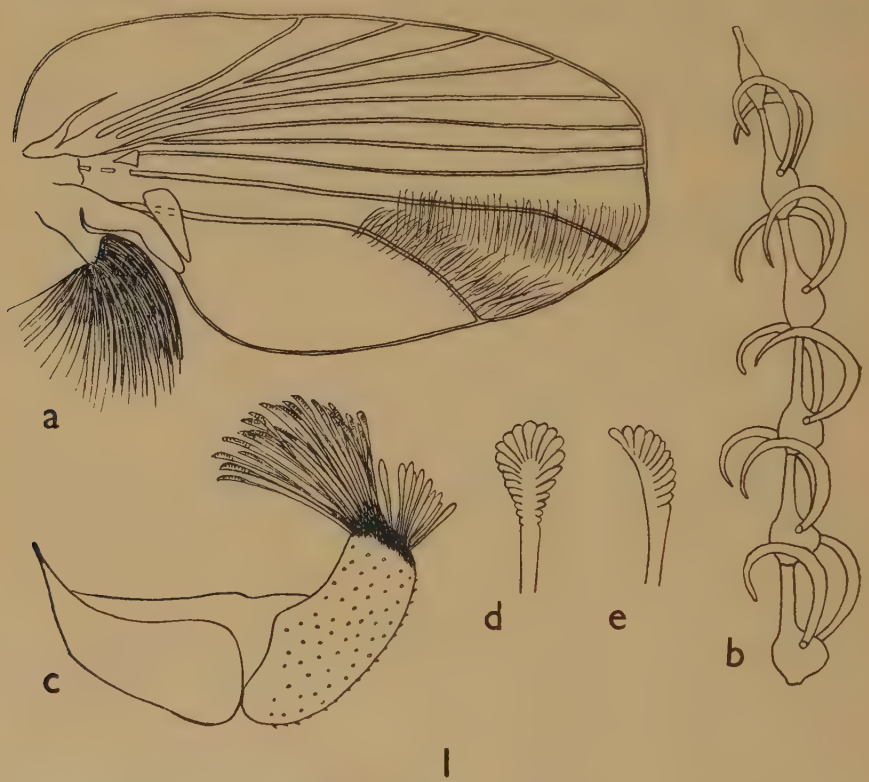


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Fig. 1.—*Brunettia unipunctata* sp. n. (*a*) Wing of male; hairs indicated on mediocubital pocket and scales on alula, remainder omitted; (*b*) segments 10–15 of antenna, verticils omitted; (*c*) cercopods in lateral aspect; (*d*) apex of racket-shaped hair in face aspect; (*e*) the same in lateral aspect.

Abdomen.—Black with brownish hairs. Cercopods short and stout with an apical brush of 10 normal retinacula and about 20–25 long racket-shaped hairs (fig. 1*c*); apex of each racket-shaped hair formed of a series of imbricate scales (figs. 1*d*, 1*e*); aedeagus and styles broken, but remainder of genitalia fairly similar to *B. biformis* Edwards.

Female.—Not known. It is to be presumed that when this sex is found, the wings will be simple without the pocket between M_4 and Cu and possibly without the anal and humeral enlargements; there should be a single white spot at the apex of R_4.

Holotype, male, Fiji, Nadarivatu, 25.ix.50 (*B. A. O'Connor*), on car windscreen.

Brunettia infurcata sp. n.

A large species; males with broad wings. Humeral region enlarged, membrane clothed with scales in cells C and Cu only; posterior fork absent; club-shaped organ present behind head; coxites and aedeagus fused, styles elongate. Separable from all other species of *Brunettia* so far described by the distribution of scales on the wing membrane.

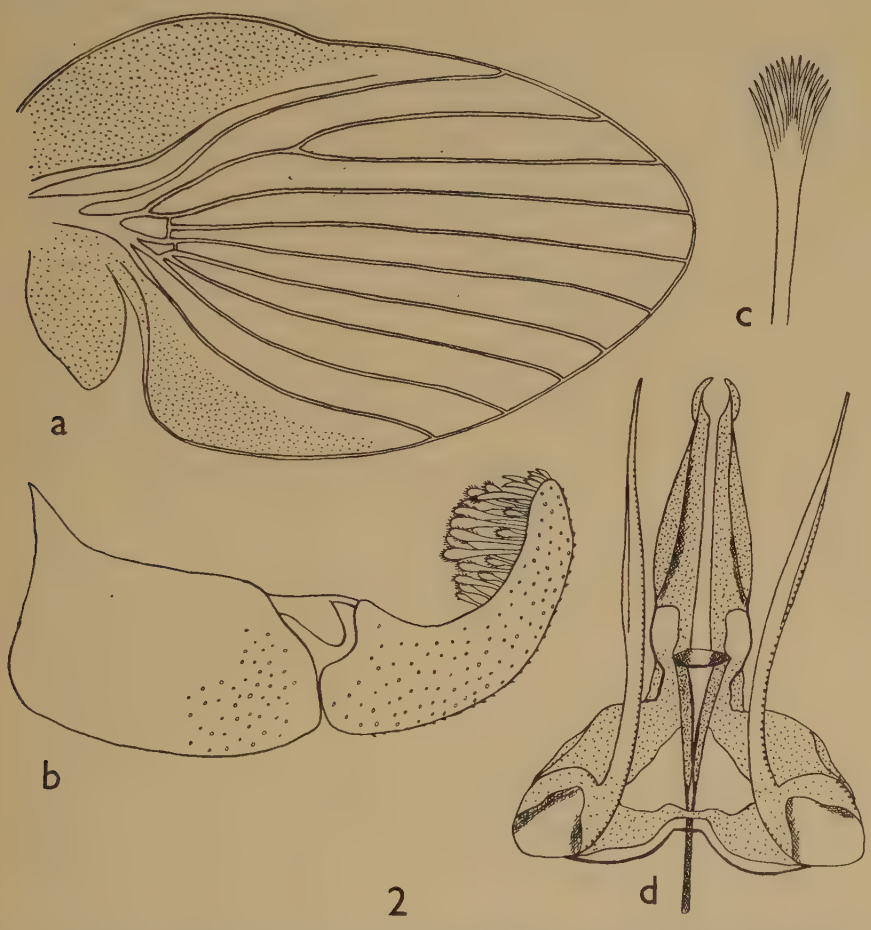

Fig. 2.—*Brunettia infurcata* sp. n. (*a*) Wing of male, scale-bearing areas stippled; (*b*) cercopods in lateral aspect; (*c*) apex of racket-shaped hair in face aspect; (*d*) coxites, styles, and aedeagus in sternal aspect (dorsal on specimen).

Male.—Wing length, 4 mm.

Head.—Dark, with an upstanding tuft of black scales on face, other scales and hairs also dark; eyes strongly kidney-shaped, with broad eye-bridges 7 facets wide meeting in the mid-line; two elongate club-shaped organs behind head as in *B. obscura* Tonn. Antennae missing in the unique specimen.

Thorax.—Brown; mesonotum clothed dorsally with short erect brown scales; scutellum and wing-bases with tufts of long whitish scales and hairs; pleura with greyish hair;

near anterior spiracle is an oval swollen area covered with dark scales longer than those of the dorsum.

Legs.—Clothed uniformly with brownish scales ; no distinguishing markings.

Wings.—Broad, without spots or markings ; membrane dark brown and largely bare, humeral region expanded and margin sinuous ; venation as in fig. 2*a*, Rs not pectinate ; posterior fork absent ; M_1 and M_2 with separate origins. Upper surface with adpressed, fairly narrow, whitish scales arising from all veins and from the membrane only in the areas (humeral and anal) shown stippled in the figure, veins and these areas of membrane also carry upright whitish hairs, remainder of membrane quite bare ; fringe pale brown, composed of hairs and scales mixed. Lower surface with adpressed scales only, in exactly the same areas as on the upper surface ; scales whitish and narrow on veins R_1, R_2 and R_3 and on humeral area, changing to darker, brown, broader scales on remaining veins and in anal area ; humeral area partly covered by a long adpressed fringe of whitish scales arising from the costa. Alula with short white scales and a tuft of long brownish hairs and scales. Halteres with white scales.

Abdomen.—Clothed with a mixture of whitish and brownish hairs. Cercopods (fig. 2*b*) bearing about 30 racket-shaped hairs on their inner sternal aspect ; extreme apical ones short and simple, progressively developing a form as shown enlarged in fig. 2*c*. Coxites and aedeagus fused ; aedeagus elongate symmetrical (fig. 2*d*) ; styles basally bulbous, drawn out into a long styliform process.

Female.—Not known.

Holotype, male, India, Darjeeling, Rungbong Valley, Gopaldhara, vi.1920 (*H. Stevens*).

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